Original claims 1-32 have been amended in formal respects only to improve the wording and to place them in better conformance with U.S. practice and not for patentability purposes. Accordingly, applicants submit that claims 1-32 have not been narrowed within the meaning of Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 56 U.S.P.Q.2d 1865 (Fed. Cir. 2000). New claims 33-49 have been added to cover the alternative limitations in the original claims and to provide a fuller scope of coverage.

Submitted herewith is an attachment entitled **"VERSION WITH MARKINGS TO SHOW CHANGES MADE"** containing a marked-up copy showing the changes to the specification and claims.

Early and favorable action on the merits are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner of Patents & Trademarks, Washington, D.C. 20231, on the date indicated below.

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Bruce L. Adams
Signature

JANUARY 30, 2002
Date

"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

IN THE SPECIFICATION:

Paragraph beginning at line 19 of page 1 has been amended as follows:

[Also, a] A scanning-type near-field atomic microscope [is] has also been proposed which uses an optical fiber probe formed in a hook form as a cantilever for an atomic force microscope (hereinafter, abbreviated as AFM) to illuminate laser light to a sample from a tip of the optical fiber probe simultaneous with AFM operation [detecting] to detect a surface shape and measure a sample optical characteristic (Japanese Patent Laid-open No. 174542/1995). Fig. 16 is a structural view showing a conventional optical fiber probe. This optical fiber probe uses an optical fiber 501 covered at a periphery by a metal film coating 502. [Also, a] A probe needle portion 503 is sharpened and has an aperture 504 at a tip of the probe needle portion 503.

Paragraph beginning at line 21 of page 2 has been amended as follows:

[Also, although] Although the SNOM probe shown in Fig. 17 is easy to mass-produce by a silicon process, foreign matter including dust in air readily intrudes into a recess in

a tip portion. Accordingly, there has been a problem that near-field light illuminated from the microscopic aperture is not stabilized in intensity. [Also,] Further, where the tip in position is formed at a tip of the cantilever, a spot of incident light is off the cantilever during [introducing light to] introduction of light into the microscopic aperture. [Also, when] When detecting an optical signal from a sample by the microscopic aperture, optical signals at other than the tip end are detected. Consequently, there has been a problem that the optical image of SNOM is worsened in optical-image S/N ration. [Also,] Further, because the tip is formed using mold formed of anisotropic etching of silicon, the tip at an end angle is fixed as 70 degrees. Accordingly, there has been a problem that the near-field light illuminated from the microscopic aperture cannot be increased in intensity. [Also,] Further, the lever 506 and the tip 505 are structured of a material small in reflectivity relative to a wavelength of incident light or the light detected by the microscopic aperture. In the NOM probe shown in Fig. 17, because the structural material of them is in an optical path, the intensity of incident light or detection light attenuates due to reflection upon the structural material. There has been a problem that the near-field light illuminated from the microscopic aperture 508 and the light detected by the microscopic aperture 508 are decreased in intensity.

Paragraph beginning at line 20 of page 28 has b en amended as follows:

It is [needless to say] <u>understood</u> that the content stated in Embodiment 4 and Embodiment 5 not only facilitates [to] <u>the</u> use <u>of</u> a focus lens with a great NA without using an optical lever method where the near-field optical probe 1000 has a detecting function for lever deflection and vibration amplitude but also is desirable because of <u>its</u> capability of further reducing size and weight. For example, lever deflection detection is made possible by layering piezoelectric thin films on the lever.

<u>IN THE CLAIMS</u>:

Claims 1-32 have been amended as follows:

1. (Amended) A near-field optical probe[,] comprising:

a cantilever <u>having a first main surface and a second main surface opposite the first main surface</u>;

a base [for] supporting [said] <u>the</u> cantilever <u>at the first main surface</u>;

a tip <u>extending from the second main surface of the cantilever and having a microscopic aperture at an end thereof, each of the tip and the cantilever being formed of a</u>

transparent material having a high transmissivity relative to a wavelength of light generated or detected by the microscopic aperture; and [in the form of a conical or pyramidal formed on said cantilever in a surface opposite to a surface of said base;

a microscopic aperture formed in an end of said tip;]

a shade film formed on the second main surface of [said] the cantilever [opposite to the surface of said base] and on a surface of the [said] tip except for the [excepting said] microscopic aperture[;

wherein said tip and said cantilever are formed using a transparent material high in transmissivity for a wavelength of light to be generated or detected in said microscopic aperture, said tip being filled with the transparent material].

2. (Amended) A near-field optical probe according to claim 1[,]; wherein the transparent material of the [forming said] tip is the same as [and] the transparent material of the [forming said] cantilever [are formed of a same transparent material].

3. (Amended) A near-field optical probe according to claim 2[,]; wherein the transparent material comprises [is] silicon dioxide.

4. (Amended) A near-field optical probe according to claim 1[,]; wherein the transparent material of the [forming said] tip and the transparent material of the [forming said] cantilever have [are] different [in] optical characteristics [characteristic].

5. (Amended) A near-field optical probe according to claim 1[,]; wherein [said] the tip has [is in] a circular conical [form] shape.

6. (Amended) A near-field optical probe according to claim 1[,]; wherein [said] the tip has [comprises] a plurality of surfaces having different taper angles. [cones or pyramids different in angle of a side surface of the cone or pyramid.]

7. (Amended) A near-field optical probe according to claim 1[,]; wherein [said] the cantilever has a lens for focussing [to focus] incident light to [said] the microscopic aperture or for collimating [collimate] light detected at [said] the microscopic aperture.

8. (Amended) A near-field optical probe according to claim 7[,]; wherein [said] the lens comprises [is] a Fresnel lens formed on a side of the [said] base [of said cantilever].

9. (Amended) A near-field optical probe according to claim 7[,]; wherein [said] the lens [is] comprises a refractive-index distribution-type lens [formed by controlling a refractive-index distribution in said cantilever].

10. (Amended) A near-field optical probe according to claim 1[,]; wherein an end of [said] the tip is positioned nearly in a same plane as an end surface of [said] the shade film.

11. (Amended) A near-field optical probe according to claim 1[,]; wherein an end portion of [said] the tip protrudes [greater than the] from an end face of [said] the shade film[,] in an amount [of protrusion thereof being] equal to or smaller than a half of a wavelength of incident light focussed on [said] the microscopic aperture and/or light [to be] detected at [said] the microscopic aperture.

12. (Amended) A near-field optical probe[,] comprising:

a cantilever having a first main surface and a second main surface opposite the first main surface, the cantilever being disposed at an inclination angle $\theta1$ relative to a surface of a sample;

a base [for] supporting [said] the cantilever at the first main surface;

a tip having a height H and extending from the second main surface of the cantilever and having a microscopic aperture at an end thereof; and [in the form of a conical or pyramidal formed on said cantilever in a surface opposite to a surface of said base;

a microscopic aperture formed in an end of said tip;]

a shade film formed on the second main surface of [said] the cantilever [opposite to the surface of said base] and on a surface of the [said] tip except for the [excepting said] microscopic aperture[;]

wherein[, provided that a height of said tip is H, an inclination angle of said cantilever is $\theta 1$,] when a radius of a light spot [diameter on said] on the cantilever [of] resulting from light incident on the [light onto said] tip or [a spot diameter on said cantilever of] light detected by [said] the microscopic aperture and being incident on a detector is R1, [and] a distance L1 from a center of [said] the tip to a free end of [said] the cantilever [is L1, L1 is given satisfying] satisfies the equation $R1<L1<(H/\tan \theta 1)$.

13. (Amended) A near-field optical probe according to claim 12[,]; wherein [a tip of said] an end of the cantilever has a slant portion extending from the first main surface to the second main surface. [in such a form as spreading from the tip side to the base side].

14. (Amended) A near-field optical probe according to claim 12[,]; wherein a side surface of [said] the cantilever has a slant portion extending from the first main surface to the second main surface [in such a form as spreading from the tip side to the base side].

15. (Amended) A near-field optical probe according to claim 12[,]; wherein[, at a tip of said] the cantilever[, a thin-sheet-formed] has a first portion having the first and second main surfaces, a second portion extending along a plane disposed generally parallel to the first main surface of the first portion, and a connecting portion extending in a direction opposite to the direction of extension of the tip and connecting the first portion to the second portion [connecting portion is formed in a manner protruding toward said base, a thin-sheet-formed penthouse portion being formed extending parallel with said cantilever from said connecting portion].

16. (Amended) A near-field optical probe according to claim 12[, having on said] ; wherein the cantilever has a fixed end, a free end opposite to the free end, and a convex portion [separate from said tip in position] disposed closer to the free end than the [a] fixed end [of said cantilever].

17. (Amended) A near-field optical probe according to claim 16[,]; wherein [said] the convex portion is disposed

on the second main surface of the cantilever at a [formed on said cantilever on a side forming said tip in] position closer to the fixed end than to the [said] tip[,]; and wherein a height of the tip is greater than a height of the [a height of said] convex portion [being less than a height of said tip].

18. (Amended) A near-field optical probe according to claim 16[,]; wherein [said] the convex portion is disposed on the first main surface of the tip [formed on said cantilever on a side opposite to the side forming said tip].

19. (Amended) A near-field optical apparatus comprising: [using a near-field optical probe as claimed in claim 1, the near-field optical apparatus having]

a near-field optical probe according to claim 1;

an introducing/detecting optical system having a lens for introducing light to [said] the microscopic aperture of the near-field optical probe or detecting light from [said] the microscopic aperture of the near-field optical probe; [,]

a detector for detecting a distance between [said] the microscopic aperture of the near-field optical probe and [said] a sample[,] by an optical lever method, the detector having a mirror integral with the lens of the introducing/detecting optical system; and

a fine movement mechanism for finely moving [said] the sample or [said] the near-field optical probe[,

wherein said detector uses an optical lever method,

a lens of said introducing/detecting optical system and a mirror of said detector being integrated together].

20. (Amended) A near-field optical apparatus comprising: [using a near-field optical probe as claimed in claim 1, the near-field optical apparatus having]

a near-field optical probe according to claim 1;

an introducing/detecting optical system for introducing light to [said] the microscopic aperture of the near-field optical probe or detecting light from [said] the microscopic aperture of the near-field optical probe; [,]

a detecting device for [detector] detecting a distance between [said] the microscopic aperture of the near-field optical probe and [said] a sample, the detecting device having a light source and an optical detector extending in a plane disposed generally perpendicular to the cantilever of the near-field optical probe; and

a fine movement mechanism for finely moving [said] the sample or [said] the near-field optical probe[,

wherein said detector has a light source and an optical-detector in a plane nearly vertical to said cantilever].

21. (Amended) A near-field optical apparatus according to claim 20[,]; wherein [said] the optical detector

detects [optical-detector detects reflection light upon said cantilever of] light emitted from [said] the light source and reflected by the cantilever.

22. (Amended) A near-field optical apparatus according to claim 20[,]; wherein [said] the optical detector detects [optical-detector detects diffraction light upon said cantilever of] light emitted from [said] the light source and diffracted by the cantilever.

23. (Amended) A near-field optical apparatus comprising: [using a near-field optical probe as claimed in claim 1, the near-field optical apparatus having]

a near-field optical probe according to claim 1;

an introducing/detecting optical system for introducing light to [said] the microscopic aperture of the near-field optical probe or detecting light from [said] the microscopic aperture of the near-field optical probe; [,]

a detector for detecting a distance between [said] the microscopic aperture of the near-field optical probe and [said] a sample[,] and for detecting an interference between the cantilever of the near-field optical probe and an optical fiber disposed close to the cantilever; and

a fine movement mechanism for finely moving [said] the sample or [said] the near-field optical probe[,

wherein said detector detects interference at between an optical fiber arranged close to said cantilever and said cantilever].

24. (Amended) A near-field optical apparatus <u>comprising:</u> [using a near-field optical probe as claimed in claim 1, the near-field optical apparatus having]

<u>a near-field optical probe according to claim 1;</u>

an introducing/detecting optical system <u>having a lens</u> for introducing light to [said] <u>the</u> microscopic aperture <u>of the near-field optical probe</u> or detecting light from [said] <u>the</u> microscopic aperture <u>of the near-field optical probe;</u> [,]

[detector] <u>detecting means for detecting a displacement of the cantilever of the near-field optical probe and for</u> detecting a distance between [said] <u>the</u> microscopic aperture <u>of the near-field optical probe</u> and [said] <u>a</u> sample[,]<u>;</u> and

a fine movement mechanism for finely moving [said] <u>the</u> sample or [said] <u>the</u> near-field optical probe[,

wherein said detecting means is displacement detecting means for the cantilever provided on said near-field optical probe].

25. (Amended) A near-field optical apparatus <u>comprising:</u> [using a near-field optical probe as claimed in claim 1, the near-field optical apparatus having]

a near-field optical probe according to claim 1;

an introducing/detecting optical system having an optical fiber for introducing light to [said] the microscopic aperture of the near-field optical probe or detecting light from [said] the microscopic aperture of the near-field optical probe; [,]

[detector] detecting means for detecting a distance between [said] the microscopic aperture of the near-field optical probe and [said] a sample[,]; and

a fine movement mechanism for finely moving [said] the sample or [said] the near-field optical probe[,

wherein introducing/detecting optical system has an optical fiber provided at a tip with a lens function].

26. (Amended) A method for manufacturing a near-field optical probe, comprising the steps of:

[a process of] providing a transparent member on a first main surface of a substrate;

[a process of removing] etching a part of the [said] transparent member to form [by etching and forming] a tip;

[a process of] forming a mask [for a lever] on the [said] transparent member [in a manner] covering [said] the tip and [conducting] etching the transparent member using the mask to form a lever;

[a process of] etching [said] <u>the</u> substrate from a <u>second main surface opposite to the first main</u> surface [opposite to a surface forming said lever] to form a base; and

[a process of] forming a shade film on [said] <u>the</u> lever <u>and on the tip except for an end portion of the tip.</u> [excepting an end of said tip.]

27. (Amended) A method [for manufacturing a near-field optical probe] according to claim 26[,]<u>;</u> wherein[, in] <u>the step</u> [the process] of [forming said] <u>etching to form the</u> tip[,] <u>includes the step of forming</u> a convex portion <u>in the transparent member spaced from the tip</u> [separate from said tip is formed simultaneous with said tip].

28. (Amended) A method [for manufacturing a near-field optical probe] according to claim 26[,]<u>;</u> wherein[, in] the <u>steps</u> [process] of forming <u>the mask and etching to form</u> [said] <u>the</u> lever[,] <u>include the step of forming</u> a slant portion <u>of the lever on an end portion or a side surface thereof.</u> [spreading from the tip side to said substrate side is formed in at least one of a tip or a side surface of said lever by isotropic etching.]

29. (Amended) A method [for manufacturing a near-field optical probe] according to claim 26[, comprising, a process of]<u>; further comprising the step of</u> forming a step

portion on [a] the substrate[,] prior to [the process of] providing [a] the transparent member on [said] the substrate[,]; wherein[,] in the step [process] of [forming said] etching to form the tip, [said] the transparent member is etched in part [is removed by etching] to thereby form [forming a] the tip in the vicinity of the [said] step.

30. (Amended) A method [for manufacturing a near-field optical probe] according to claim 26[, comprising,]; further comprising the steps of forming a step portion on the substrate prior to [the process of] providing [a] the transparent member on [said] the substrate, and [a process of forming a step on said substrate, and a process of] burying a weight material to be used as [for] a weight portion in the [said] step portion.

31. (Amended) A method [for manufacturing a near-field optical probe] according to claim 30[,]; wherein the [process of] burying [a material for a weight portion in said] step comprises [a process of] providing [a] the weight material [for a weight portion] on the [said] substrate [in a manner] to at least fill the [filling said] step portion with the weight material, and [a process of] removing part of the weight material [for a weight portion for making planar such] so that a surface of the weight material [for a weight

portion] provided in <u>the</u> [said] step <u>portion</u> and a surface of [said] <u>the</u> substrate <u>are disposed in a single</u> [form one] plane.

32. (Amended) A method for [manufacturing a near-field optical probe] according to claim 31[,]<u>;</u> wherein the <u>step of removing the weight material comprises</u> [process of making planar is conducted by] polishing <u>the weight material</u>.